Generation of Ethyl Ether in an Ethanol Vehicle System for Cold Start Assistance

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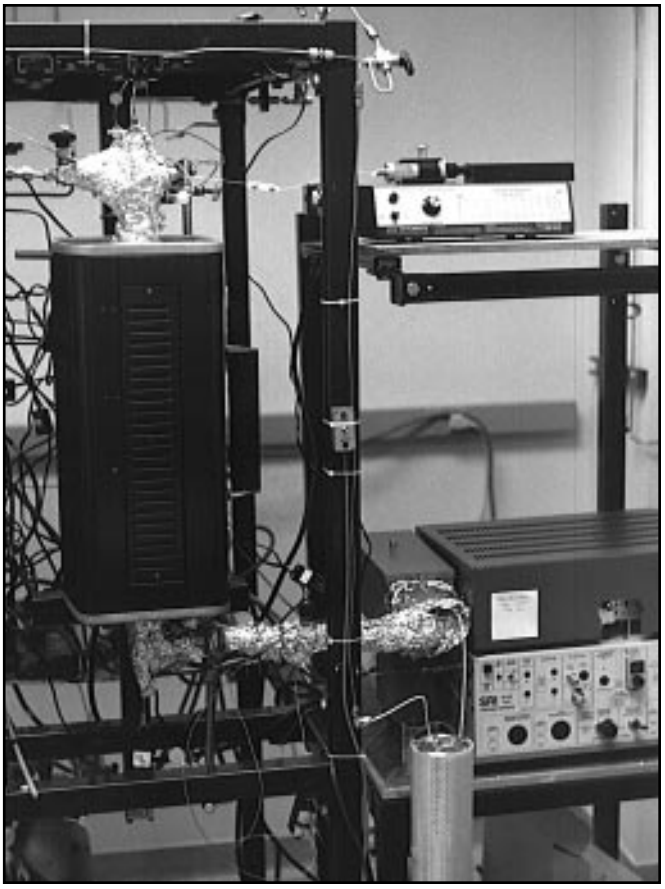
Objective

To develop an on-board catalytic converter for converting ethanol into diethyl ether to assist in the cold-starting of ethanol fueled vehicles.

Approach

This project will consist of two phases. In Phase I, the Colorado School of Mines (CSM) will evaluate conventional and new catalyst materials that can selectively produce ethyl ether from ethanol using a bench-scale reactor. Kinetic and thermodynamic data will be used to evaluate and predict the best process options. In Phase II, CSM will design and fabricate an on-board prototype catalytic converter system in coordination with researchers at the Southwest Research Institute (SwRI). The reactor will be installed on a Ford Taurus and its performance evaluated by SwRI.



Bench-scale reactor and on-line analytical system to evaluate catalyst materials

Accomplishments

CSM has constructed a bench-scale catalytic reactor and on-line analytical system. Several conventional and new catalyst materials were tested. A catalyst prepared at CSM was found to have the best activity and selectivity for this process. Because very little information is available on the use of ethanol-ether mixtures for cold starting a vehicle, ASPEN PLUS software was used to determine the vapor-liquid phase equilibria for ternary system containing ethanol, ether, and water. The amount of ether

production required to cold start the vehicle at various temperatures was estimated.

Future Direction

The rate constant and activation energy for the best catalyst material will be determined. The results will be used to design the optimum on-board reactor system. The catalyst material will be studied in more detail to understand the nature of the acidity required for the selective ether production. This information will be used to develop improved future catalyst materials.

Publications

None to date.